

## SUPPLEMENTAL AMENDMENT UNDER 1.111

Serial Number: 09/618648

Filing Date: July 18, 2000

Title: INTEGRATED CIRCUITS USING OPTICAL WAVEGUIDE INTERCONNECTS FORMED THROUGH A SEMICONDUCTOR WAFER  
AND METHODS FOR FORMING SAME

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IN THE CLAIMS

1-90 (Canceled)

91. (Previously Presented) An integrated circuit, comprising:  
at least one functional circuit formed on a wafer; and  
at least one optical waveguide formed in a high aspect ratio hole that extends through the wafer.
92. (Previously Presented) The integrated circuit of claim 91, further comprising:  
a layer of highly reflective material formed to line an inner surface of the high aspect ratio hole.
93. (Previously Presented) The integrated circuit of claim 91, wherein the optical waveguide is formed by an anodic etch that creates the high aspect ratio hole.
94. (Previously Presented) An integrated circuit, comprising:  
at least one functional circuit formed on a wafer;  
at least one optical waveguide formed in a high aspect ratio hole that extends through the wafer; and  
a layer of highly reflective material formed on an inner surface of the high aspect ratio hole.
95. (Previously Presented) The integrated circuit of claim 94, wherein the layer of highly reflective material comprises at least one layer of a metal.

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96. (Previously Presented) The integrated circuit of claim 95, wherein the layer of highly reflective material comprises:

- a layer of tungsten formed on the inner surface of the high aspect ratio hole; and
- a layer of aluminum formed on the layer of tungsten.

97. (Previously Presented) An integrated circuit, comprising:

- at least one functional circuit formed on a wafer;
- at least one optical waveguide formed in a high aspect ratio hole that extend through the wafer; and
- a mirror-like layer including aluminum formed on an inner surface of the high aspect ratio holes.

98. (Previously Presented) The integrated circuit of claim 97, wherein the mirror-like layer has a thickness of approximately 300 angstroms.

99. (Previously Presented) The integrated circuit of claim 97, wherein the mirror-like layer is formed to provide a reflective surface that is substantially uniform.

100. (Currently Amended) The integrated circuit of claim ~~91~~ 90, wherein at least one optical waveguide is adapted to receive optical signals from at least one optical transmitter.

101. (Currently Amended) The integrated circuit of claim ~~91~~ 90, wherein at least one optical waveguide is adapted to transmit optical signals to at least one optical receiver.

102. (Previously Presented) An integrated circuit, comprising:

- at least one memory circuit formed on a wafer;
- at least one optical waveguide formed in a high aspect ratio hole that extends through the wafer, the high aspect ratio hole including an inner surface; and
- a layer of reflective material formed to line the inner surface of the high aspect ratio hole.

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103. (Currently Amended) The integrated circuit of claim 102 ~~104~~, wherein the wafer is adapted to be anodically etched to create the high aspect ratio hole.
104. (Currently Amended) The integrated circuit of claim 102 ~~104~~, wherein the layer of reflective material has a thickness of approximately 300 angstroms.
105. (Previously Presented) The integrated circuit of claim 104, wherein the layer of reflective material includes a substantially uniform thickness.
106. (Previously Presented) An integrated circuit, comprising:  
at least one memory circuit formed on a wafer;  
at least one optical waveguide formed in a high aspect ratio hole that extends through the wafer, the high aspect ratio hole including an inner surface; and  
a reflective aluminum layer to line the inner surface of the high aspect ratio hole.
107. (Previously Presented) The integrated circuit of claim 106, wherein the reflective aluminum layer has a substantially uniform thickness.
108. (Previously Presented) The integrated circuit of claim 107, wherein the reflective aluminum layer has a thickness of approximately 300 angstroms.
109. (Currently Amended) An integrated circuit, comprising:  
at least one functional circuit formed on a wafer; and  
at least one optical waveguide formed in a high aspect ratio hole that extends through the wafer, the ~~at least one~~ optical waveguide includes a diameter above a cut-off diameter for transmission of light waves.
110. (Currently Amended) The integrated circuit of claim 109, wherein the diameter of the ~~at least one~~ optical waveguide is at least three times the cut-off diameter for transmission of light

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waves.

111. (Currently Amended) The integrated circuit of claim 109, wherein the diameter of the ~~at least one~~ optical waveguide is ten times the cut-off diameter for transmission of light waves.

112. (Currently Amended) The integrated circuit of claim 109, wherein the diameter of the ~~at least one~~ optical waveguide is six microns.

113. (Currently Amended) An integrated circuit, comprising:  
at least one functional circuit formed on a wafer; and  
at least one optical waveguide formed in a high aspect ratio hole that extends through the wafer, the ~~at least one~~ optical waveguide includes a filling material that has an index of refraction greater than 1.0.

114. (Currently Amended) The integrated circuit of claim 113, wherein the ~~at least one~~ optical waveguide includes a diameter above a cut-off diameter for transmission of light waves.

115. (Currently Amended) The integrated circuit of claim 113, wherein the high aspect ratio hole includes an inner surface, and wherein the ~~at least one~~ optical waveguide includes a reflective aluminum layer lining the inner surface of the high aspect ratio hole.

116. (Previously Presented) The integrated circuit of claim 115, wherein the reflective aluminum layer has a substantially uniform thickness.

117. (Previously Presented) The integrated circuit of claim 115, wherein the reflective aluminum layer has a thickness of approximately 300 angstroms.

118. (Previously Presented) An integrated circuit, comprising:  
at least one memory circuit formed on a wafer;  
at least one optical waveguide formed in a high aspect ratio hole that extends through the

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wafer, the high aspect ratio hole including an inner surface; and

a metallic mirror lining the inner surface of the high aspect ratio hole.

119. (Previously Presented) The integrated circuit of claim 118, wherein the metallic mirror has a substantially uniform thickness.

120. (Previously Presented) The integrated circuit of claim 119, wherein the metallic mirror layer has a thickness of approximately 300 angstroms.

121. (Previously Presented) The integrated circuit of claim 120, wherein the metallic mirror layer includes a layer of tungsten.

122. (Previously Presented) The integrated circuit of claim 121, wherein the metallic mirror layer includes a layer of aluminum.

123. (Previously Presented) The integrated circuit of claim 118, wherein the metallic mirror layer includes a layer of tungsten.

124. (Previously Presented) The integrated circuit of claim 123, wherein the metallic mirror layer includes a layer of aluminum.

125. (Currently Amended) The integrated circuit of claim 124, wherein the metallic mirror defines a diameter of the ~~at least one~~ optical waveguide, and wherein the diameter is above a cut-off diameter for transmission of optical waves.

126. (Previously Presented) The integrated circuit of claim 124, wherein the diameter is at least three times a cut-off diameter for transmission of optical waves.

127. (Currently Amended) The integrated circuit of claim 124, wherein the diameter is ten times a cut-off diameter for transmission of an optical wave.